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Supplement 2

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INVESTIGATION OF ATMOSPHERIC PROPERTIES BASED UPON
EVALUATION OF INFRARED RADIATION DATA OBTAINED FROM
TIROS SATELLITES

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1. INVESTIGATIONS BEING UNDERTAKEN

a. Parts of investigations sponsored by this NASA-Grant are concerned with evaluations of infrared radiation data of the TIROS IV meteorological satellite with the purpose to determine from them the following three quantities:

- (1) The surface temperature of the lower boundary (ground and/or clouds),
- (2) the mean relative humidity of the upper troposphere, and
- (3) the total water vapor mass above the 500 mb level.

These evaluations also include extensive studies of the radiation data in order to find out the degradation of the sensors after launch of the satellite.

The results were obtained in form of quasi-global maps of ten-day and monthly averages of each quantity.

b. In a second part investigations are undertaken to calculate the spectrum of the outgoing radiation or the equivalent temperature in several infrared spectral regions. A method has been developed to perform the calculations with high spectral resolution. Here we use so far experimental transmission functions of the atmospheric gases according to the laboratory measurements of D.E.Burch, D.Gryvnak, E.B.Singleton, W.L.France, and D.Williams. Furthermore we have investigated the influence of different parameters on the outgoing radiation, for example

- (1) the influence of the height of clouds, of their emissivity and of mixing ratios of the atmospheric gases,
- (2) the influence of different weighting functions d^r/dh ; these are applied for single gases as well as several gases with overlapping absorption. This may be essential for selecting spectral intervals for inversion experiments.

Another method to calculate the outgoing radiation, which has already been reported on in May 1965 under NSG-305, has been applied to the spectral region of the Nimbus I HRIR instrument between 3.4 and 4.2 microns.

2. FUTURE WORK (NASA Grant NSG-Supplement No. 3):

- a. Some statistical investigations of the results described under 1 a will be carried out for a thorough interpretation.
- b. New laboratory measurements as yet unpublished of the transmission of atmospheric gases with a resolution of 5 cm^{-1} will be used in the above mentioned program.

Because the new absorption measurements include recordings with several absorbing gases in one cell we will be able to study the effect of overlapping of the bands. The measurements could be performed in a joint program between the University of Munich and the Ohio State University last autumn.

3. FINAL REPORT:

A final report will be prepared under this Grant.

Part I will contain the evaluations of TIROS IV radiation data.

Part II will contain the investigations of the prediction of spectra of the outgoing radiation as well as the calculations in the Nimbus channel.

4. PAPERS, SUBMITTED TO SCIENTIFIC MEETINGS:

Under the title "A Quasiglobal Analysis of Tropospheric Water Vapor Content and its Temporal Variations From Radiation Data of the Meteorological Satellite TIROS IV" will be reported

- (1) at the AMS-AGU Spring Meeting in Washington D.C. (April 22, 1966),
- (2) at the "Meteorologen-Tagung 1966" in München, Germany (April 27, 1966),
- (3) at the COSPAR Meeting in Vienna, Austria (May 11-17, 1966).

Authors of all three papers are Mr. E. RASCHKE (Universität München) and Mr. W.R.BANDEEN (Goddard Space Flight Center).

5. TRAVELS:

Dr. E. RASCHKE was from the 24th of September 1965 until the 23rd of February 1966 with the Laboratory of Atmospheric and Biological Sciences of the G.S.F.C., Greenbelt. There he carried out the evaluations of TIROS IV radiation data in co-operation with staff members of that laboratory.

I. TANNHAEUSER attended the 16th International Astronautical Congress which was held from 13th to 18th September 1965 in Athens.

6. PERSONNEL AND ADMINISTRATIONS:

Project Director : Prof. Dr. F. Möller

Research Associates : Dr. E. Raschke

Dipl.-Phys. I. Tamhöller

Technical Associates: F. Lehner

Students : Vick

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Renasco

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München, den 31. März 1966

f. Möller

(Prof. Dr. Fritz Möller)